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Highly Cited Works in Animal Clinical Trials: A Scientometric mapping of Research Publications

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Abstract

This paper analyses the 2555 publications with more than 100 citations indexed in Web of Science under research in Animal Clinical Trials. These publications have been received 556159 Citations, written by 13280 authors from 2833 institutes across the world. The most productive countries are: USA is the leading country with 1442 (56.4%), UK with 304 (11.9%), Germany 209 (8.2%), Canada 179(7%), Australia (130), Italy (132), Netherlands (116). It is noted that 13 Countries registered more than 10000 Citations, 23 with more than 5000 Citations, 38 Countries with more than 1000 Citations. The most cited Institutions are: Harvard University is leading with 27478 Citations for 108 publications followed University of California San Diego with 14896 Citations for 46 Publications, University of Pettsburgh with 13746 Citations for 38 Publications, Johns Hopikins University with 12120 Citations for 53 Publications. There are 929 periodicals are preferred and also with high impact. The most cited journals are: Cancer Research published the largest number of the highly cited publications (50 papers, 10620 Citations), followed by Circulation with 9998 Citations for 37 Publications, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA with 9317 Citations for 32 Publications, Lancet with 9181 Citations, JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION with 7547 Citations for 21 Publications and New England Journal of Medicine with 6944 Citations for 11 Publications. The most cited authors are: Ahmad N with 4554 Citations for 4 Publications followed by Kellum JA and Ronco C with 4372 Citations for 2 publications respectively, Altman DG with 4231 Citations for 3 Publications. The most cited one is "Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P (2004). Acute renal failure - definition, outcome measures, animal models, fluid therapy and information technology needs: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group", published in CRITICAL CARE with 4181 Citations.

Keywords: Animal Clinical Trials; Highly Cited works; Scientometrics;

INTRODUCTION

In simple terms, scientometrics is the knowledge of measuring science, which includes all quantitative and qualitative methods related to the production and dissemination of knowledge and technology and, by analyzing these aspects, it contributes to a proper understanding of scientific research. Web of Science (WOS), is a unique set and an analytical and research tool widely used by

scientometric indicators for scientific evaluations of Institutions, Journals and Researchers. In other words, highly cited papers in this database are among the top one percent of international publications. The choice of authors, journals, or institutions to be recorded in the database. By searching each of these, we can have access to its set of highly cited papers. Number of citations: This index is, in fact, a step beyond the number of papers and is used to measure the impact of papers, journals, and researchers on scientific communities. A large number of citations is an indicator of a prominent paper. Average citation per paper: It is used to evaluate the quality and influence of scientific products.

OBJECTIVES OF THE STUDY

Citations are assumed to be a reflection of research articles use and impact. The main objective of this publication is to examine the characteristics of highly cited publications in Animal Clinical Trials published during the period of 1989 and 2021. The study, in particular, will assess:

- The annual distribution of contribution of Publications and Citations;
- The contribution made by authors and organizations;
- Geographical wise distribution of Publications and Citations;
- Single and Multiple Country Publications;
- Most preferred Journals;
- Medium for communication of publications
- Highly Cited papers;
- Most Cited authors and Institutions;

METHODOLOGY

The study derived highly cited works from the Web of Science, an international multidisciplinary bibliographical and citation database covered the period from 1989 to 2021. A highly cited article was defined, as an article registering at least 100 citations since its publication up to 20 March 2021. The search string was “Animal Clinical Trials” with topic field. In total, 2555 highly

cited articles in Animal Clinical Trials (World output of 30147 articles) received at least 100 citations since publication.

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1990:2020
Sources (Journals, Books, etc)	929
Documents	2555
Average years from publication	15
Average citations per documents	217.7
Average citations per year per doc	16.01
References	200747
DOCUMENT CONTENTS	
Keywords Plus (ID)	11394
Author's Keywords (DE)	4844
AUTHORS	
Authors	13280
Author Appearances	14905
Authors of single-authored documents	269
Authors of multi-authored documents	13011
AUTHORS COLLABORATION	
Single-authored documents	292
Documents per Author	0.192
Authors per Document	5.2
Co-Authors per Documents	5.83
Collaboration Index	5.75

DATA ANALYSIS AND INTERPRETATIONS

Geographical wise Distribution of Publications

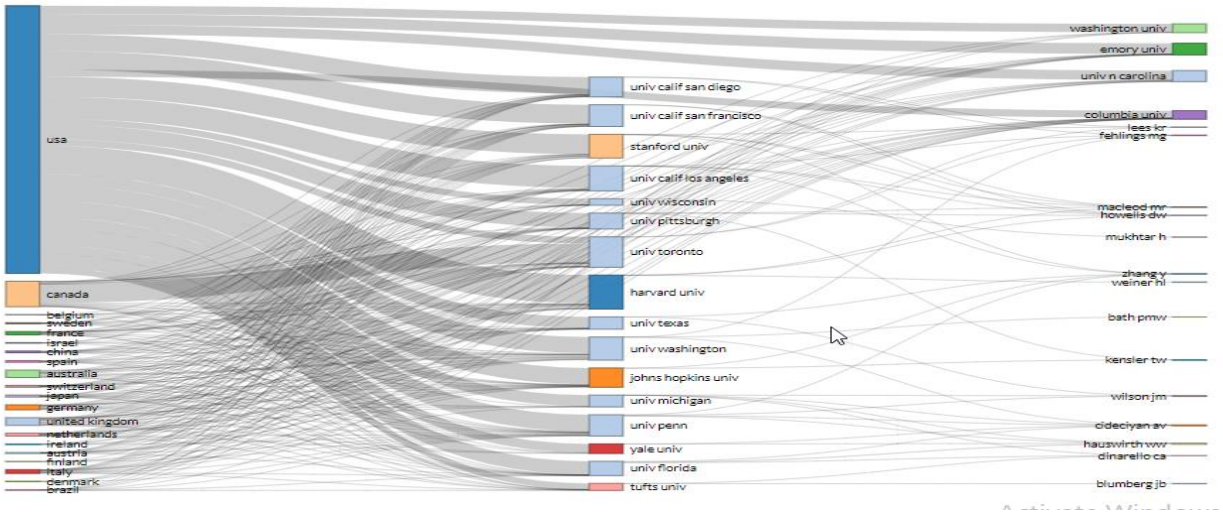
There were a total of 64 countries involved the research in Animal Clinical Trials during the period of 1990–2021. The most productive countries are: USA is the leading country with 1442 (56.4%), UK with 304 (11.9%), Germany 209 (8.2%), Canada 179(7%), Australia (130), Italy (132), Netherlands (116). The most cited countries are: USA is at the top most position with contain with 327546 Citations for 1442 Publications (ACPP: 227.147) followed by UK with 72384 Citations for 304 Publications (ACPP: 238.1053), Germany with 44734 Citations for 209 publications (ACPP: 214.0383), Canada with 36628 Citations for 209 publications (ACPP: 204.6257). It is noted that 13 Countries registered more

than 10000 Citations, 23 with more than 5000 Citations, 38 Countries with more than 1000 Citations.

Table: 1 Geographical wise Distribution of Publications

Publication Impact						Citation Impact			
S.No	**Country**	**Records**	**%**	**Citation**		**Country**	**Records**	**Citation**	**ACPP**
1	USA	1442	56.4	327546		USA	1442	327546	227.147
2	UK	304	11.9	72384		UK	304	72384	238.1053
3	Germany	209	8.2	44734		Germany	209	44734	214.0383
4	Canada	179	7.0	36628		Canada	179	36628	204.6257
5	Australia	130	5.1	32451		Australia	130	32451	249.6231
6	Italy	123	4.8	28020		Italy	123	28020	227.8049
7	Netherlands	116	4.5	25759		Netherlands	116	25759	222.0603
8	France	113	4.4	23428		France	113	23428	207.3274
9	Switzerland	79	3.1	17075		Switzerland	79	17075	216.1392
10	Japan	74	2.9	14595		Japan	74	14595	197.2297
11	Peoples R China	59	2.3	11400		Spain	58	13950	240.5172
12	Sweden	59	2.3	12004		Sweden	59	12004	203.4576
13	Spain	58	2.3	13950		Peoples R China	59	11400	193.2203
14	Belgium	40	1.6	9268		Belgium	40	9268	231.7
15	Israel	39	1.5	8367		Israel	39	8367	214.5385
16	Denmark	37	1.4	6940		Denmark	37	6940	187.5676
17	Brazil	30	1.2	6226		Brazil	30	6226	207.5333
18	Austria	28	1.1	5023		Ireland	23	5751	250.0435
19	India	28	1.1	5488		India	28	5488	196
20	Finland	25	1.0	5058		South Korea	22	5485	249.3182
21	Ireland	23	0.9	5751		Poland	18	5147	285.9444
22	South Korea	22	0.9	5485		Finland	25	5058	202.32
23	New Zealand	20	0.8	3234		Austria	28	5023	179.3929
24	Poland	18	0.7	5147		New Zealand	20	3234	161.7
25	Iran	12	0.5	1949		Singapore	12	2643	220.25
26	Singapore	12	0.5	2643		Norway	11	2466	224.1818
27	Norway	11	0.4	2466		Portugal	9	2241	249
28	Czech Republic	10	0.4	2045		Czech Republic	10	2045	204.5
29	Greece	10	0.4	1776		Iran	12	1949	162.4167
30	Taiwan	10	0.4	1899		Taiwan	10	1899	189.9
31	Portugal	9	0.4	2241		Greece	10	1776	177.6
32	Saudi Arabia	7	0.3	1775		Saudi Arabia	7	1775	253.5714
33	South Africa	7	0.3	1080		Russia	2	1604	802
34	Mexico	6	0.2	1108		Hungary	4	1403	350.75
35	Turkey	5	0.2	1349		Slovakia	3	1376	458.6667
36	Hungary	4	0.2	1403		Turkey	5	1349	269.8
37	Argentina	3	0.1	781		Mexico	6	1108	184.6667
38	Egypt	3	0.1	373		South Africa	7	1080	154.2857
39	Peru	3	0.1	691		Argentina	3	781	260.3333
40	Romania	3	0.1	388		Tunisia	1	781	781
41	Slovakia	3	0.1	1376		Peru	3	691	230.3333
42	Chile	2	0.1	284		Pakistan	2	593	296.5
43	Jordan	2	0.1	251		Uruguay	2	524	262
44	Lebanon	2	0.1	259		Malaysia	1	393	393
45	Pakistan	2	0.1	593		Romania	3	388	129.3333
46	Philippines	2	0.1	228		Egypt	3	373	124.3333
47	Qatar	2	0.1	303		Ukraine	2	363	181.5

48	Russia	2	0.1	1604		Qatar	2	303	151.5
49	Ukraine	2	0.1	363		Chile	2	284	142
50	Uruguay	2	0.1	524		Oman	1	276	276
51	Colombia	1	0.0	158		Lebanon	2	259	129.5
52	Cote Ivoire	1	0.0	123		Jordan	2	251	125.5
53	Croatia	1	0.0	129		Philippines	2	228	114
54	Ethiopia	1	0.0	185		Jamaica	1	210	210
55	Ghana	1	0.0	134		Ethiopia	1	185	185
56	Jamaica	1	0.0	210		Nigeria	1	163	163
57	Luxembourg	1	0.0	122		Colombia	1	158	158
58	Malaysia	1	0.0	393		Sri Lanka	1	148	148
59	Nigeria	1	0.0	163		Ghana	1	134	134
60	Oman	1	0.0	276		Croatia	1	129	129
61	Sri Lanka	1	0.0	148		Cote Ivoire	1	123	123
62	Thailand	1	0.0	117		Luxembourg	1	122	122
63	Tunisia	1	0.0	781		Thailand	1	117	117
64	Uganda	1	0.0	114		Uganda	1	114	114

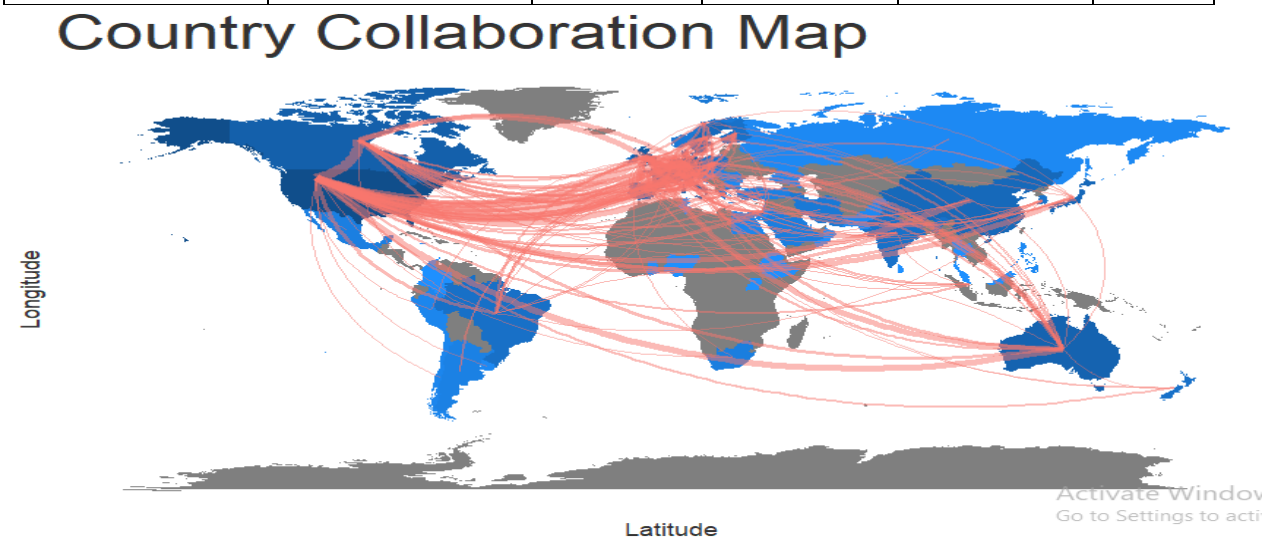


Three Fields Plot (Country, Institutions and Authors)

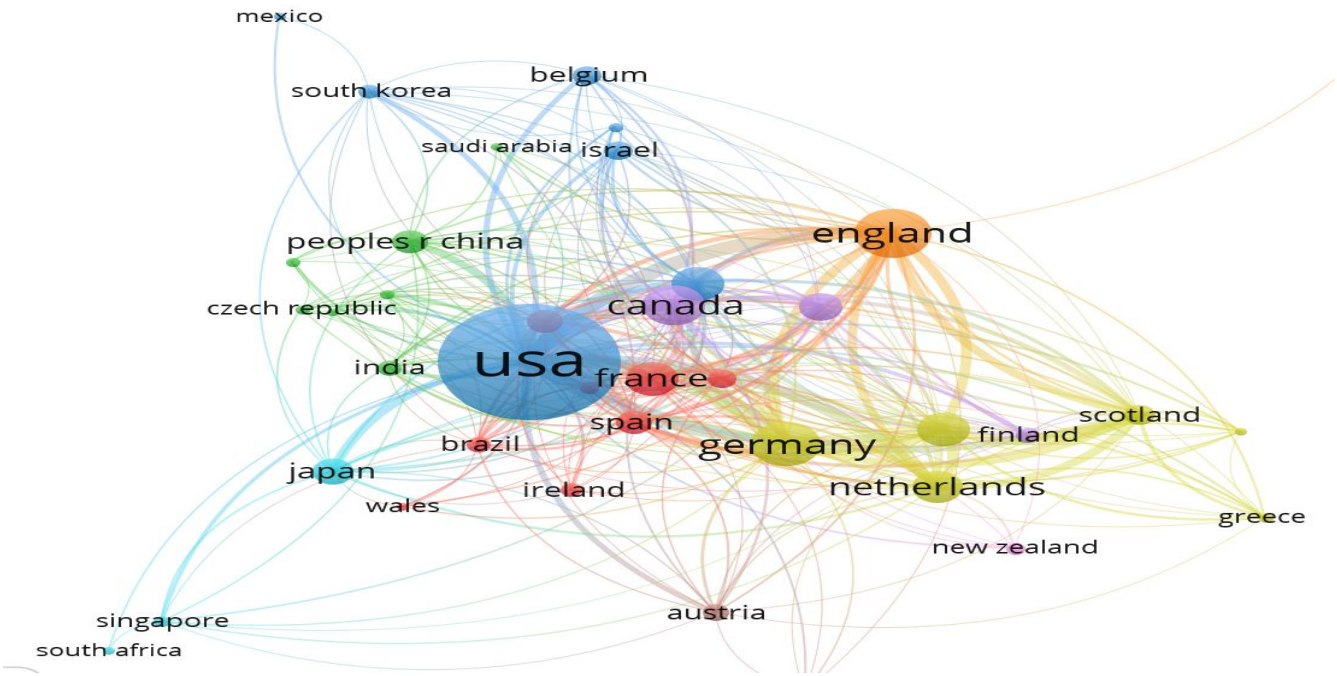
Table: 1A Country Collaboration

From	To	Frequency			
USA	UNITED KINGDOM	90	USA	AUSTRIA	16
USA	GERMANY	89	USA	SWEDEN	16
USA	CANADA	78	CANADA	FRANCE	15
USA	ITALY	54	GERMANY	SPAIN	15
USA	AUSTRALIA	43	NETHERLANDS	SWITZERLAND	15
USA	NETHERLANDS	42	UNITED KINGDOM	SWITZERLAND	15
USA	FRANCE	40	USA	BELGIUM	15
UNITED KINGDOM	GERMANY	34	AUSTRALIA	NETHERLANDS	14
USA	SWITZERLAND	34	CANADA	ITALY	14
UNITED KINGDOM	AUSTRALIA	31	GERMANY	AUSTRALIA	14
USA	CHINA	29	USA	ISRAEL	14
UNITED KINGDOM	NETHERLANDS	27	UNITED KINGDOM	SWEDEN	13

UNITED KINGDOM	CANADA	26	USA	KOREA	13
USA	JAPAN	26	CANADA	NETHERLANDS	12
GERMANY	NETHERLANDS	23	CANADA	SWITZERLAND	12
GERMANY	SWITZERLAND	23	FRANCE	ITALY	12
UNITED KINGDOM	ITALY	23	FRANCE	SPAIN	12
USA	SPAIN	23	ITALY	SPAIN	12
UNITED KINGDOM	FRANCE	22	CANADA	AUSTRALIA	11
GERMANY	FRANCE	21	GERMANY	AUSTRIA	11
GERMANY	CANADA	20	UNITED KINGDOM	BELGIUM	11
FRANCE	SWITZERLAND	17	USA	BRAZIL	11
GERMANY	ITALY	17	USA	IRELAND	11
FRANCE	NETHERLANDS	16	ITALY	NETHERLANDS	10
UNITED KINGDOM	SPAIN	16	ITALY	SWITZERLAND	10



Country	Documents	Citations	Total link strength
usa	1497	343242	1330
england	266	63023	618
germany	225	47679	567
australia	129	32163	464
scotland	44	10532	415
netherlands	121	29132	401
canada	179	36628	370
italy	132	30001	241
france	124	25946	181
spain	62	14517	177
sweden	61	12256	144
switzerland	88	19034	134
japan	75	14735	115
denmark	37	7447	95
peoples r china	60	11640	86
austria	31	6193	61
brazil	30	6226	57
india	28	5488	53
finland	27	6229	48
israel	40	8552	45



Citation Network of Countries

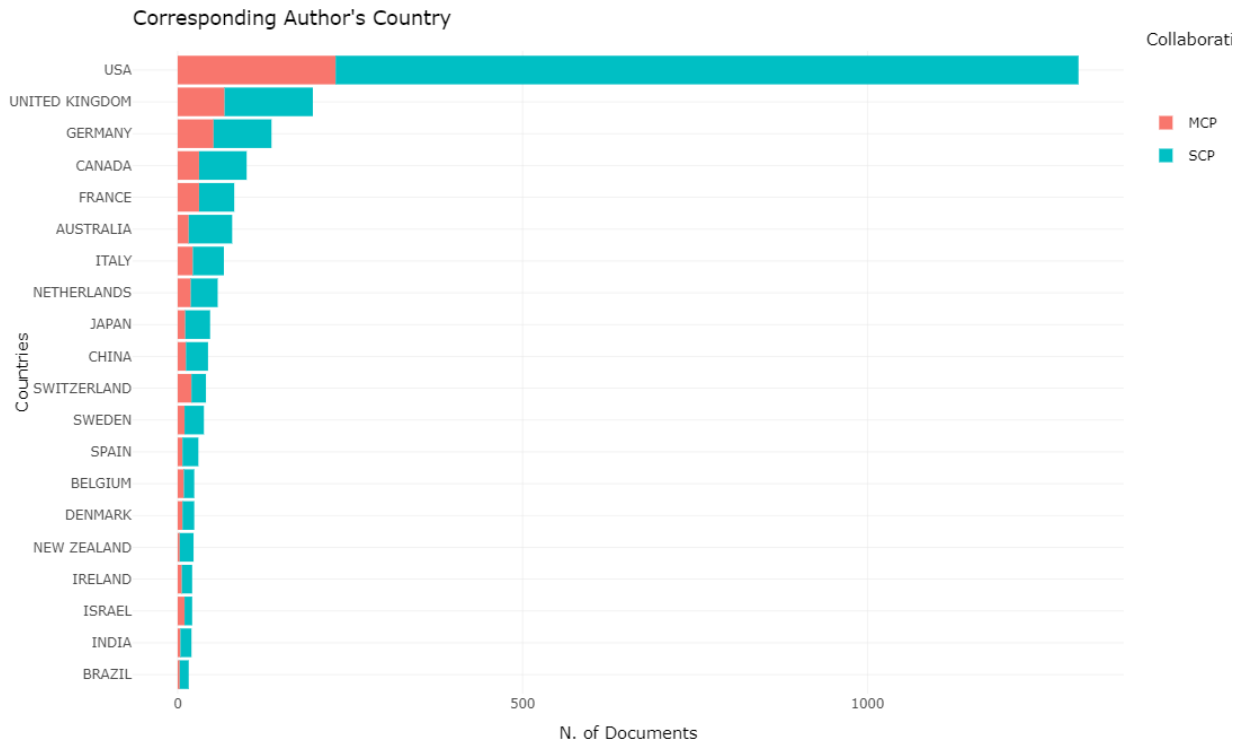
Correspinding Author's Country

The below table shows that there are two types of articles: single country publications (SCP) in which all authors belong to the same country and such publications represent intra-country collaboration; and multiple country publications (MCP) in which authors belong to different countries and such publications represent inter-country collaboration i.e. international collaboration

Table: 1B Correspinding Author's Country

Country	Articles	Frequency	Single Country Publications	Multiple Country Publications	MCP_Ratio
USA	1306	0.527038	1077	229	0.175
UNITED KINGDOM	196	0.079096	128	68	0.347
GERMANY	136	0.054883	84	52	0.382
CANADA	100	0.040355	69	31	0.31
FRANCE	82	0.033091	51	31	0.378
AUSTRALIA	79	0.031881	63	16	0.203
ITALY	67	0.027038	45	22	0.328
NETHERLANDS	58	0.023406	39	19	0.328
JAPAN	47	0.018967	36	11	0.234
CHINA	44	0.017756	32	12	0.273

SWITZERLAND	41	0.016546	21	20	0.488
SWEDEN	38	0.015335	28	10	0.263
SPAIN	30	0.012107	23	7	0.233
BELGIUM	24	0.009685	15	9	0.375
DENMARK	24	0.009685	17	7	0.292
NEW ZEALAND	23	0.009282	20	3	0.13
IRELAND	21	0.008475	15	6	0.286
ISRAEL	21	0.008475	11	10	0.476
INDIA	20	0.008071	16	4	0.2
BRAZIL	16	0.006457	13	3	0.188
FINLAND	15	0.006053	10	5	0.333
IRAN	10	0.004036	7	3	0.3
KOREA	10	0.004036	8	2	0.2
POLAND	9	0.003632	8	1	0.111
AUSTRIA	8	0.003228	4	4	0.5
GREECE	7	0.002825	3	4	0.571
CZECH REPUBLIC	5	0.002018	4	1	0.2
NORWAY	5	0.002018	2	3	0.6
PORTUGAL	5	0.002018	5	0	0
MEXICO	4	0.001614	4	0	0
SINGAPORE	4	0.001614	3	1	0.25
SLOVAKIA	4	0.001614	2	2	0.5
SOUTH AFRICA	3	0.001211	3	0	0
LEBANON	2	0.000807	0	2	1
ARGENTINA	1	0.000404	0	1	1
CHILE	1	0.000404	0	1	1
CROATIA	1	0.000404	0	1	1
ERITREA	1	0.000404	1	0	0
HUNGARY	1	0.000404	1	0	0
MALAYSIA	1	0.000404	1	0	0
PAKISTAN	1	0.000404	0	1	1
PERU	1	0.000404	0	1	1
PHILIPPINES	1	0.000404	0	1	1
ROMANIA	1	0.000404	1	0	0
SAUDI ARABIA	1	0.000404	0	1	1
THAILAND	1	0.000404	1	0	0
TURKEY	1	0.000404	1	0	0
UKRAINE	1	0.000404	0	1	1



Year wise Distribution of publications and Citations

Total of 2555 publications are published on Animal Clinical trials during 1990-2021. Table 2 shows the year-wise distribution of publication with Citations. The year-wise publication productivity trend in Animal clinical trials during these 31 years. The highest number of citation in 2008 with 40773 Citation for 176 Publications followed by 2004 with 37601 Citations for 144 Publications, 2006 with 35337 Citations for 152 Publications, 2010 with 33625 citations for 149 Publications. It is noted that from 1995 to 2015 registered more than 10000 Citations each Year. 1990, 2019 and 2020 registered single digit of publications and below 2000 Citations.

Table: 2 Year wise distribution of Publications

#	Year	Records	%	Citations		Year	Records	Citations
1	2008	176	6.9	40773		2008	176	40773
2	2011	154	6.0	28718		2004	144	37601
3	2006	152	5.9	35337		2006	152	35337
4	2010	149	5.8	33625		2010	149	33625
5	2004	144	5.6	37601		2009	140	31648
6	2007	140	5.5	30452		2007	140	30452
7	2009	140	5.5	31648		2011	154	28718
8	2005	134	5.2	26626		2005	134	26626
9	2002	119	4.7	25674		2013	113	25861
10	2012	115	4.5	21733		2003	112	25800

11	2013	113	4.4	25861		2002	119	25674
12	2003	112	4.4	25800		2001	107	21952
13	2001	107	4.2	21952		2012	115	21733
14	2000	102	4.0	21256		2000	102	21256
15	1999	91	3.6	18461		1999	91	18461
16	2014	85	3.3	16337		2014	85	16337
17	2015	73	2.9	14118		1998	66	16144
18	1998	66	2.6	16144		2015	73	14118
19	1997	50	2.0	13984		1997	50	13984
20	2016	50	2.0	7372		1996	45	11842
21	1995	45	1.8	10646		1995	45	10646
22	1996	45	1.8	11842		1991	32	8966
23	2017	44	1.7	7766		2017	44	7766
24	1993	35	1.4	6433		1994	34	7463
25	1994	34	1.3	7463		2016	50	7372
26	1991	32	1.3	8966		1993	35	6433
27	1992	17	0.7	3487		1992	17	3487
28	2018	17	0.7	2971		2018	17	2971
29	2019	7	0.3	932		2020	6	1742
30	2020	6	0.2	1742		2019	7	932
31	1990	1	0.0	439		1990	1	439

Most Cited Institutions (2833)

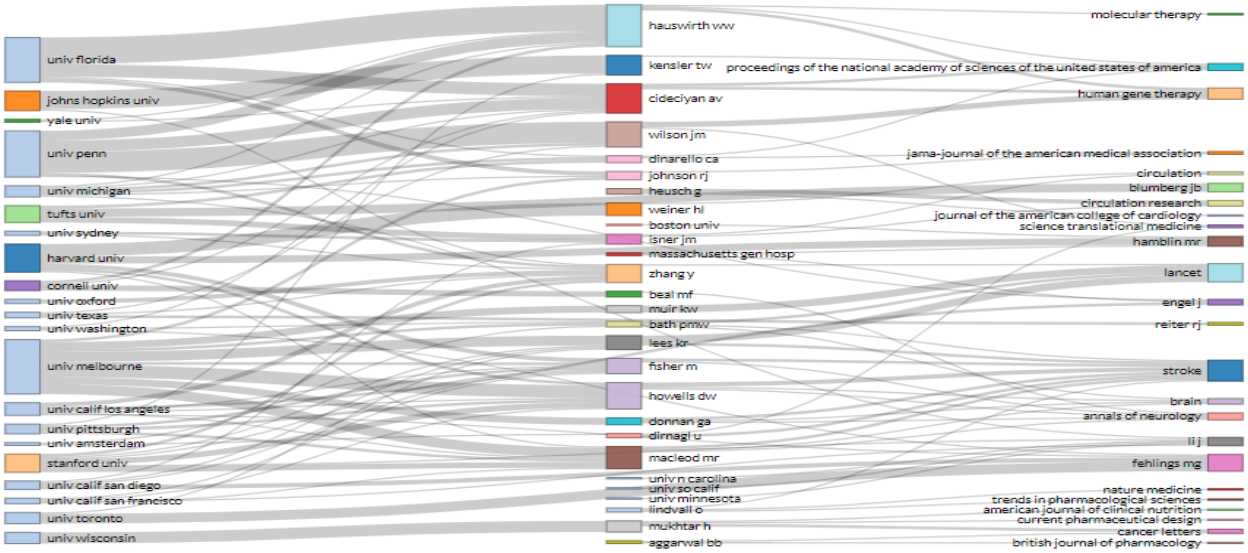
In all, 2833 Institutions had participated in Animal Clinical Trials research during 1989–2021. Of the 111 research organizations are each had published 10-108 range of publications and 314 institutions with more 1000 Citations each and highest citations of 27478, 35 Institutions with more than 5000 citations. The most cited Institutions are: Harvard University is leading with 27478 Citations for 108 publications followed University of California San Diego with 14896 Citations for 46 Publications, University of Pettsburgh with 13746 Citations for 38 Publications, Johns Hopikins University with 12120 Citations for 53 Publications. Their share of highly cited papers in Animal Clinical Trials was the largest (4.2%, 183 papers), followed by institutes of national importance (34.59% share, 137 papers), Johns Hopkins University (2.1% share, 53 papers), University of Penn (2.1% share, 53 papers) respectively, University of Calif Los Angeles and University of Toronto (2% share, 50 papers) respectively.

Table: 3 Most Cited Institutions (2833)

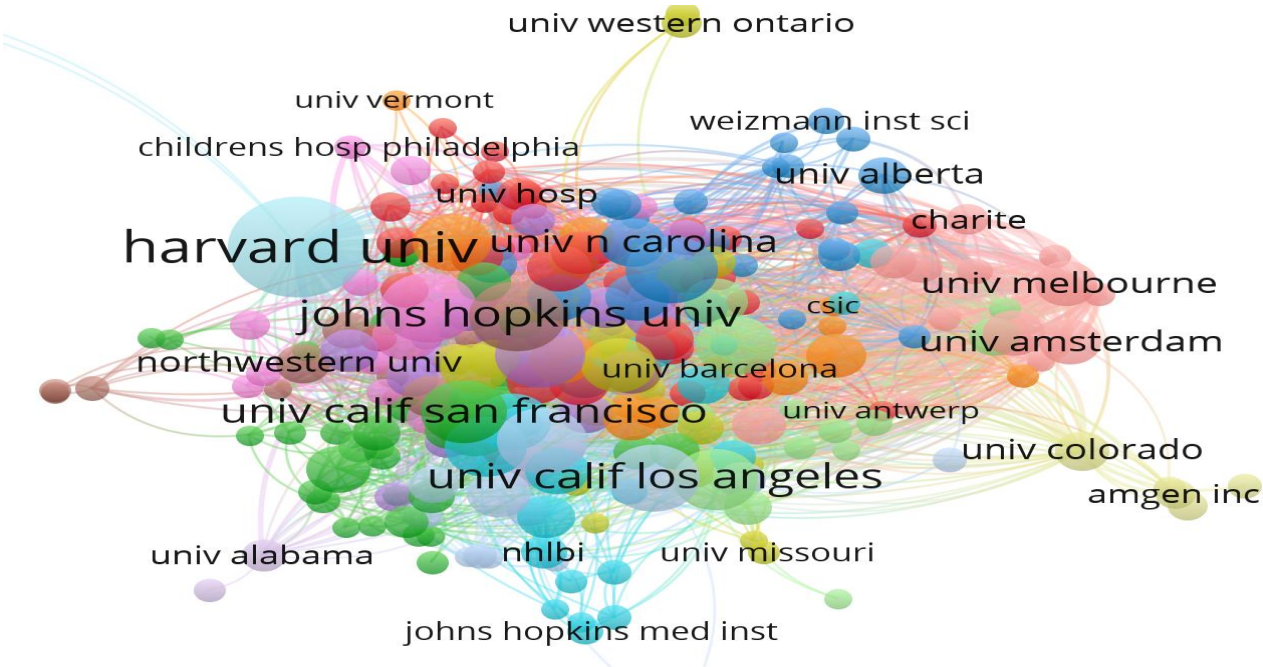
#	Institution	Records	Citations	ACPP
1	Harvard University	108	27478	
2	University Calif San Diego	46	14896	
3	University of Pittsburgh	38	13746	
4	Johns Hopkins University	53	12120	

5	University Calif San Francisco	44	11831	
6	University Toronto	50	11779	
7	University Penn	53	11154	
8	Stanford University	42	10774	
9	University Texas	46	10352	
10	University Calif Los Angeles	50	9878	
11	Washington University	23	9518	
12	University Michigan	39	9374	
13	Massachusetts Gen Hosp	34	8954	
14	University Florida	26	8660	
15	University Oxford	22	8437	
16	University Wisconsin	24	8038	
17	NCI	35	8031	
18	Univ Washington	33	7653	
19	Univ Melbourne	24	7649	
20	Columbia Univ	24	7269	
21	Univ Chicago	19	6668	
22	Yale Univ	27	6654	
23	Tufts Univ	30	6471	
24	Univ N Carolina	25	6317	
25	Brigham & Womens Hosp	24	6287	
26	Univ London Imperial Coll Sci Technol & Med	17	6222	
27	Univ Colorado	18	6128	
28	Univ Edinburgh	23	6109	
29	Case Western Reserve Univ	21	5550	
30	Univ Bristol	12	5366	
31	Cornell Univ	24	5342	
32	Univ Minnesota	24	5287	
33	Univ So Calif	19	5184	
34	Univ Amsterdam	23	5148	
35	Duke Univ	18	5045	
36	Emory Univ	23	4937	
37	Mem Sloan Kettering Canc Ctr	17	4826	
38	UCL	20	4664	
39	Univ Massachusetts	17	4627	
40	Indiana Univ	13	4625	
41	Univ Texas MD Anderson Canc Ctr	12	4553	
42	Cleveland Clin Fdn	16	4505	
43	Univ Utah	19	4394	
44	Virginia Commonwealth Univ	18	4390	
45	Tulane Univ	11	4348	
46	Kings Coll London	16	4269	
47	Austin Hlth	1	4181	
48	San Bortolo Hosp	1	4181	
49	VA Pittsburgh Healthcare Syst	1	4181	
50	Univ Rochester	11	4126	
51	Univ Kentucky	13	4099	
52	Univ Calif Irvine	13	4090	

53	Univ Maryland	21	4066	
54	Ohio State Univ	19	4029	
55	Univ Sydney	23	4026	
56	Beth Israel Deaconess Med Ctr	18	4008	
57	Univ Med & Dent New Jersey	9	3984	
58	Univ Alabama Birmingham	19	3951	
59	Cleveland Clin	15	3925	
60	Univ Cambridge	17	3894	



Three Fields Plot: (Institutions, Authors and Sources)



Citation Network of Institutions

Organization	Documents	Citations	Total link strength
univ edinburgh	22	5428	360
univ melbourne	22	6846	291
natl stroke res inst	6	2559	237
harvard univ	107	26797	224
univ penn	52	10916	174
univ calif san diego	46	14896	155
univ florida	26	8660	154
univ med ctr utrecht	8	2352	147
univ toronto	49	11541	135
stanford univ	41	10093	134
univ oxford	21	8315	119
univ massachusetts	16	3946	107
johns hopkins univ	53	12120	101
univ med ctr	5	1067	97
univ washington	32	7531	96
univ calif los angeles	49	9197	95
univ amsterdam	22	5026	92
univ michigan	39	9374	91
univ nottingham	12	2273	77
univ calif san francisco	43	11150	76

Medium of communication

Review is play an important role in the communication structure of research in Animal Clinical Trials. Of the 2555 highly cited papers, 1180 were published in Review, Article with 1137 (44.5%), Article; Proceedings paper with 188 (7.4%). The remains are published in Review; Book Chapter, Editorials Materials, Note, Reprint and Article; Book Chapter.

Table :4 Medium of Communication

#	Document Type	Records	%	Citations
1	Review	1180	46.2	259953
2	Article	1137	44.5	250099
3	Article; Proceedings Paper	188	7.4	33265
4	Review; Book Chapter	22	0.9	5087
5	Editorial Material	16	0.6	5166
6	Note	8	0.3	1760
7	Reprint	3	0.1	707
8	Article; Book Chapter	1	0.0	122

Most Cited Sources

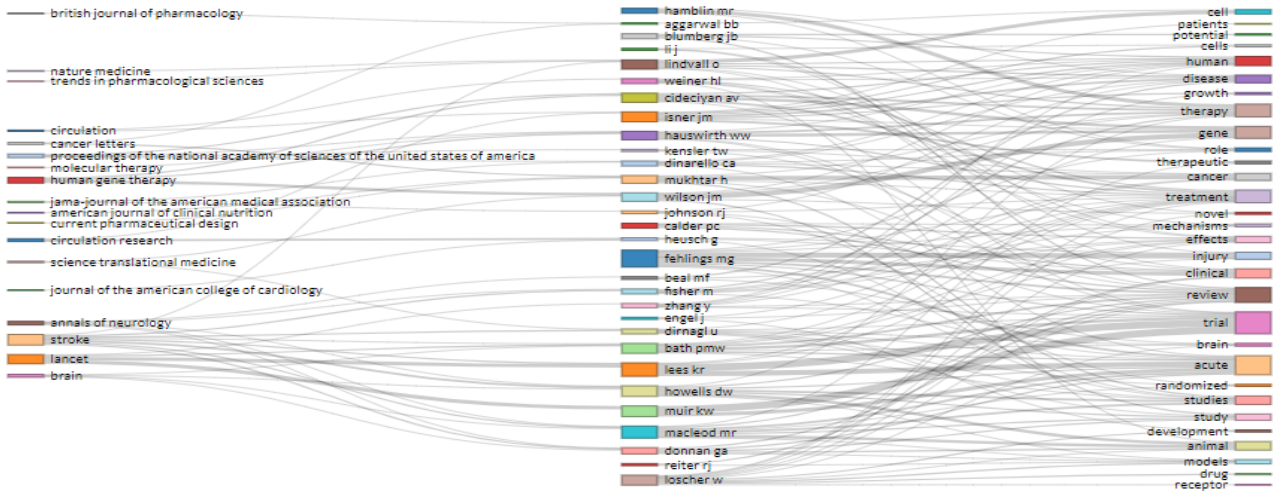
Table list top 60 highly cited Sources. 929 journals which published 1 or more highly cited publications, 128 journals registered more than 1000 Citations and 10 journals received more than 5000 Citations. The most cited journals are: Cancer Research published the largest number of the highly cited publications (50 papers, 10620 Citations), followed by Circulation with 9998 Citations for 37 Publications, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA with 9317 Citations for 32 Publications, Lancet with 9181 Citations, JAMA-JOURNAL OF THE AMERICAN MEDICAL

ASSOCIATION with 7547 Citations for 21 Publications and New England Journal of Medicine with 6944 Citations for 11 Publications. The High Impact Journals are: New England journal of Medicine with 74.699 High Impact followed by Nature Review Drug Discovery and American Journal of Clinical Nutrition with 30 Impact Factor respectively, LACET with 60.392. It is noted that 31 Journal with more than 10 Impact Factor and highest IF is 74.699.

Table:5 Most Cited Journals

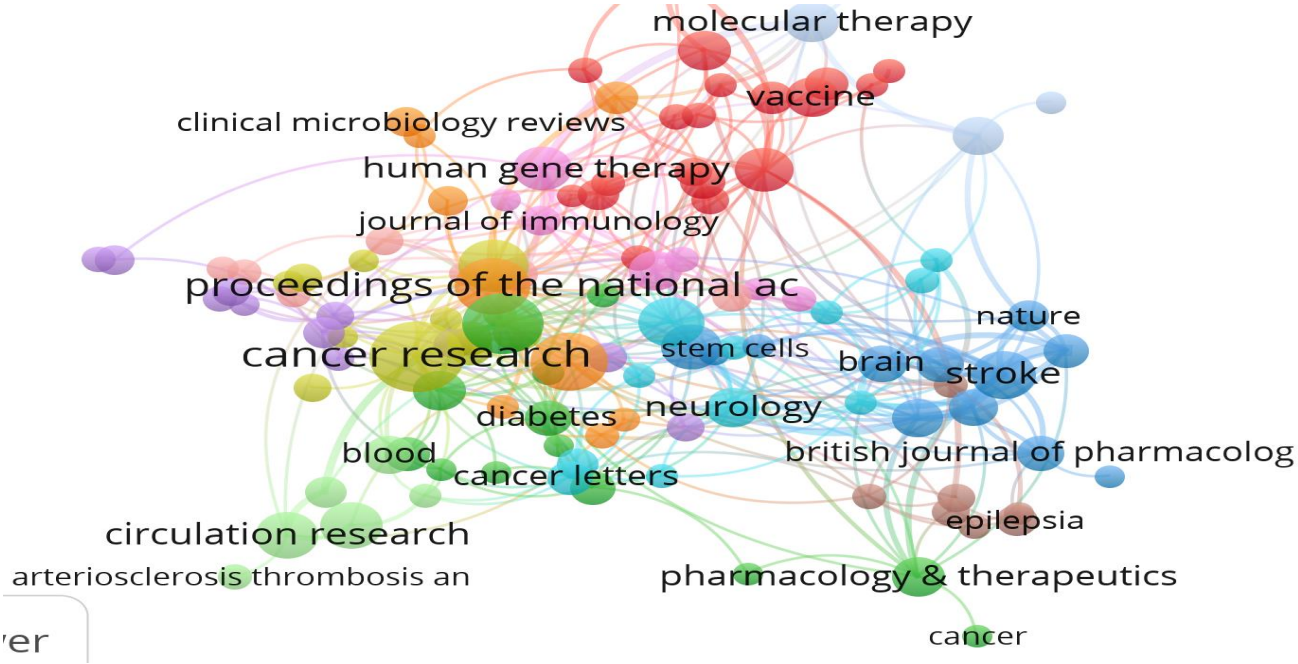
#	Journal	Impact Factor	Records	Citations
1	CANCER RESEARCH	9.130	50	10620
2	CIRCULATION	23.603	37	9998
3	PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	9.412	32	9317
4	LANCET	60.392	24	9181
5	JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION	45.540	21	7547
6	NEW ENGLAND JOURNAL OF MEDICINE	74.699	11	6944
7	NATURE MEDICINE	36.130	16	6504
8	NATURE REVIEWS DRUG DISCOVERY	64.797	19	5826
9	AMERICAN JOURNAL OF CLINICAL NUTRITION	64.797	16	5678
10	DRUGS	4.690	34	5197
11	CRITICAL CARE	7.442	5	4972
12	STROKE	7.19	23	4891
13	CIRCULATION RESEARCH	15.862	22	4810
14	CLINICAL CANCER RESEARCH	10.107	27	4567
15	SCIENCE TRANSLATIONAL MEDICINE	16.304	15	4143
16	LANCET NEUROLOGY	30.039	13	4049
17	BRAIN	11.337	14	3949
18	JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY	20.589	22	3935
19	FASEB JOURNAL	4.966	4	3890
20	NEUROLOGY	8.055	16	3881
21	PLOS BIOLOGY	7.076	3	3669
22	HUMAN GENE THERAPY	4.228	19	3612
23	CANCER LETTERS	7.360	12	3551
24	ANNALS OF NEUROLOGY	9.037	15	3525
25	ANNUAL REVIEW OF IMMUNOLOGY	19.900	3	3414
26	JOURNAL OF CLINICAL INVESTIGATION	11.864	12	3414
27	BLOOD	17.543	15	3292
28	BRITISH JOURNAL OF NUTRITION	3.334	9	3117
29	JOURNAL OF IMMUNOLOGY	4.718	9	3031
30	TRENDS IN PHARMACOLOGICAL SCIENCES	13.503	14	3028
31	CRITICAL CARE MEDICINE	7.442	16	2989
32	BIOCHEMICAL PHARMACOLOGY	5.009	9	2953
33	GASTROENTEROLOGY	20.877	14	2934
34	CLINICAL MICROBIOLOGY REVIEWS	17.406	9	2914
35	DIABETES	7.72	13	2734
36	PHARMACOLOGICAL REVIEWS	17.099	7	2705
37	MOLECULAR THERAPY	8.402	17	2674
38	STEM CELLS	5.614	6	2670
39	PHARMACOLOGY & THERAPEUTICS	11.127	16	2598

40	JOURNAL OF CLINICAL ENDOCRINOLOGY & METABOLISM	5.605	7	2574
41	VACCINE	3.143	16	2567
42	CARDIOVASCULAR RESEARCH	8.168	10	2453
43	KIDNEY INTERNATIONAL	8.395	12	2396
44	NATURE	42.778	10	2373
45	FREE RADICAL BIOLOGY AND MEDICINE	6.17	7	2350
46	BRITISH JOURNAL OF PHARMACOLOGY	7.73	13	2313
47	JOURNAL OF THE AMERICAN SOCIETY OF NEPHROLOGY	9.274	12	2288
48	AMERICAN JOURNAL OF RESPIRATORY AND CRITICAL CARE MEDICINE	17.452	11	2189
49	JOURNAL OF CLINICAL ONCOLOGY	32.956	9	2183
50	NATURE REVIEWS NEUROLOGY	27.000	9	2136
51	TRANSPLANTATION	4.743	7	2120
52	PSYCHOPHARMACOLOGY	3.424	10	2093
53	PROGRESS IN RETINAL AND EYE RESEARCH	15.432	11	2071
54	ANNUAL REVIEW OF MEDICINE	9.716	5	2054
55	JOURNAL OF THE AMERICAN COLLEGE OF NUTRITION	2.430	4	2036
56	NATURE BIOTECHNOLOGY	36.558	6	2019
57	BIOLOGICAL PSYCHIATRY	12.095	8	2003
58	ENDOCRINE REVIEWS	15.745	7	1990
59	ANNALS OF INTERNAL MEDICINE	21.317	8	1899
60	NATURE NEUROSCIENCE	20.071	4	1869



Three Fields Plot: (Sources, Authors and Titles)

Source	Documents	Citations	Total link strength
stroke	23	4891	68
journal of cerebral blood flow and ...	12	1659	38
brain	14	3949	37
annals of neurology	15	3525	34
human gene therapy	19	3612	31
proceedings of the national acade...	32	9317	31
circulation	37	9998	26
nature reviews drug discovery	19	5826	26
cancer research	50	10620	24
nature medicine	16	6504	23
trends in neurosciences	6	1220	23
molecular therapy	17	2674	22
neurology	16	3881	22
lancet	24	9181	18
trends in pharmacological sciences	14	3028	18
pharmacology & therapeutics	16	2598	17
progress in neurobiology	7	1515	17
new england journal of medicine	11	6944	16
science translational medicine	15	4143	15
jama-journal of the american medi...	21	7547	14



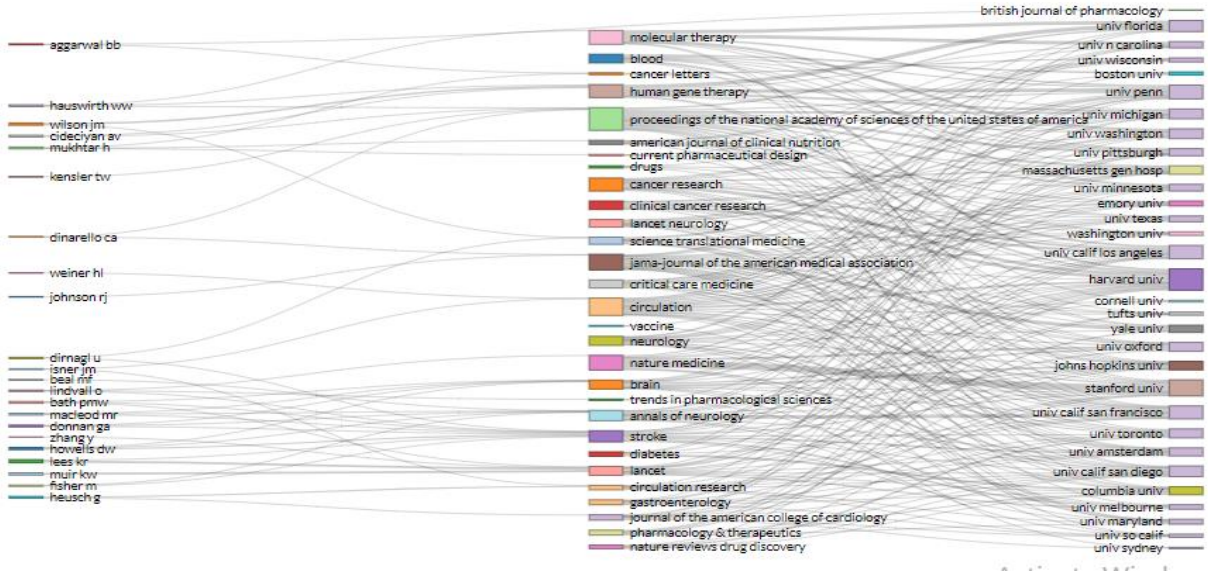
Most Productive and Cited Authors

The leading authors were Howells DW (11 papers) with 3893 Citations followed by Macleod MR with 10 publications and received 3094 Citations, Wilson JM with 9 Publications and received 2273 Citations, Fehlings MG with 8 publications and received 1224 Citations, Dinarello CA with 7 publications and received 1941 Citations. The most cited authors are: Ahmad N with 4554 Citations for 4 Publications followed by Kellum JA and Ronco C with 4372 Citations for 2 publications respectively, Altman DG with 4231 Citations for 3 Publications, Bellomo R, Mehta RL and Palevsky P with 4181 citations for single publications. It is note that 281 authors registered more than 1000 Citations, 1158 authors with more than 500 Citations and 13280 authors with more than 100 Citations.

Table: 6 Most Productive and Cited Authors

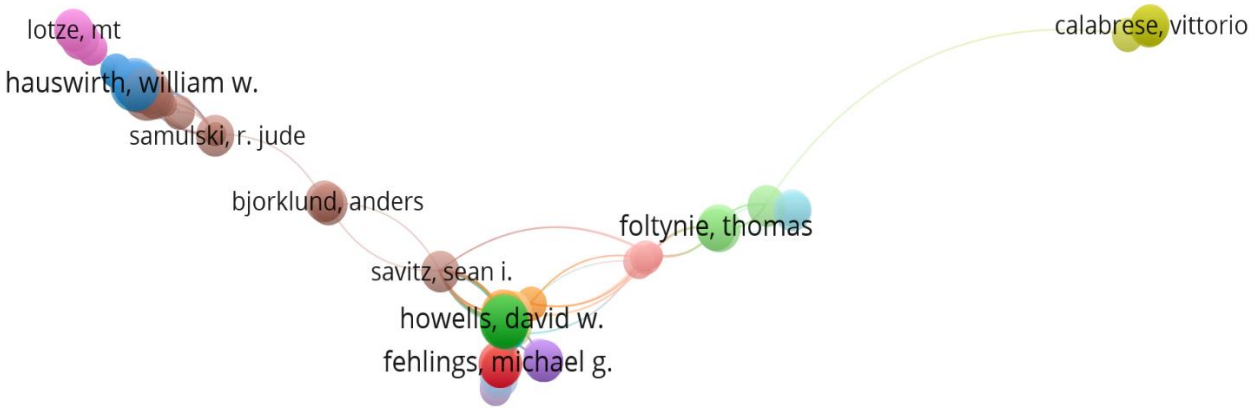
Most productive Authors					Most Cited Authors		
#	Author	Records	Citations		Author	Records	Citations
1	Howells DW	11	3893		Ahmad N	4	4554
2	Macleod MR	10	3094		Kellum JA	2	4372
3	Wilson JM	9	2273		Ronco C	2	4372
4	Fehlings MG	8	1224		Altman DG	3	4231

5	Dinarello CA	7	1941		Bellomo R	1	4181
6	Lees KR	7	1752		Mehta RL	1	4181
7	Mukhtar H	7	1940		Palevsky P	1	4181
8	Aggarwal BB	6	3010		Howells DW	11	3893
9	Bath PMW	6	1062		Browne WJ	2	3648
10	Calder PC	6	2121		Cuthill IC	2	3648
11	Donnan GA	6	1980		Emerson M	2	3648
12	Hauswirth WW	6	1732		Kilkenny C	2	3648
13	Kensler TW	6	2049		Nihal M	1	3372
14	Lindvall O	6	1914		Reagan-Shaw S	1	3372
15	Loscher W	6	1612		Macleod MR	10	3094
16	Weiner HL	6	2199		Aggarwal BB	6	3010
17	Zhang Y	6	2163		vanDeventer SJH	2	2824
18	Beal MF	5	1112		Prockop DJ	4	2822
19	Blumberg JB	5	1451		Simopoulos AP	2	2796
20	Cideciyan AV	5	1313		Hanauer SB	2	2705
21	Dirnagl U	5	909		Feldmann M	2	2609
22	Engel J	5	595		Maini RN	2	2609
23	Fisher M	5	1988		Braakman T	1	2538
24	Hamblin MR	5	2308		DeWoody KL	1	2538
25	Heusch G	5	965		Mayer L	1	2538
26	Isner JM	5	1412		Present DH	1	2538
27	Johnson RJ	5	1290		Rutgeerts PJ	1	2538
28	Li J	5	720		Schaible TF	1	2538
29	Muir KW	5	1370		Targan SR	1	2538
30	Reiter RJ	5	830		Hamblin MR	5	2308



Three Fields Plot: (Authors, Sources and Institutions)

Author	Documents	Citations	Total link strength
howells, david w.	5	1574	307
macleod, malcolm r.	5	914	257
dirnagl, ulrich	4	713	254
macleod, malcolm	3	827	246
sena, emily	3	827	246
van der worp, h. bart	4	879	240
sena, emily s.	4	776	238
donnan, ga	4	1468	234
howells, dw	4	1468	234
macleod, mr	3	1329	234
hauswirth, william w.	5	1311	216
cideciyan, artur v.	4	1112	183
boye, sanford l.	4	1147	175
horky, ll	2	1018	175
o'collins, t	2	438	136
aleman, tomas s.	3	962	130
donnan, geoffrey a.	2	512	130
jacobson, samuel g.	3	962	130
bath, philip m. w.	3	402	128
foltynie, thomas	4	731	125



Highly Cited papers

Table 7 shows the 27 leading articles in Animal Clinical Trials with >1000 Citations. Both citation numbers and ranking of the papers are displayed. The most cited one is “Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P (2004). Acute renal failure - definition, outcome measures, animal models, fluid therapy and information technology needs: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group”, published in CRITICAL CARE with 4181 Citations followed by Kilkenny C, Browne WJ, Cuthill IC, Emerson M, Altman DG (2010). Improving Bioscience Research Reporting: The ARRIVE Guidelines for Reporting Animal Research”, published in PLOS BIOLOGY with 3375 Citations, next Reagan-Shaw S, Nihal M, Ahmad N (2008), Dose translation from animal to human studies revisited”, published in FASEB JOURNAL with 3372 Citations. It is noted that 27 papers registered more than 1000 Citations, 135 papers with more than 500 citations and 222 papers with

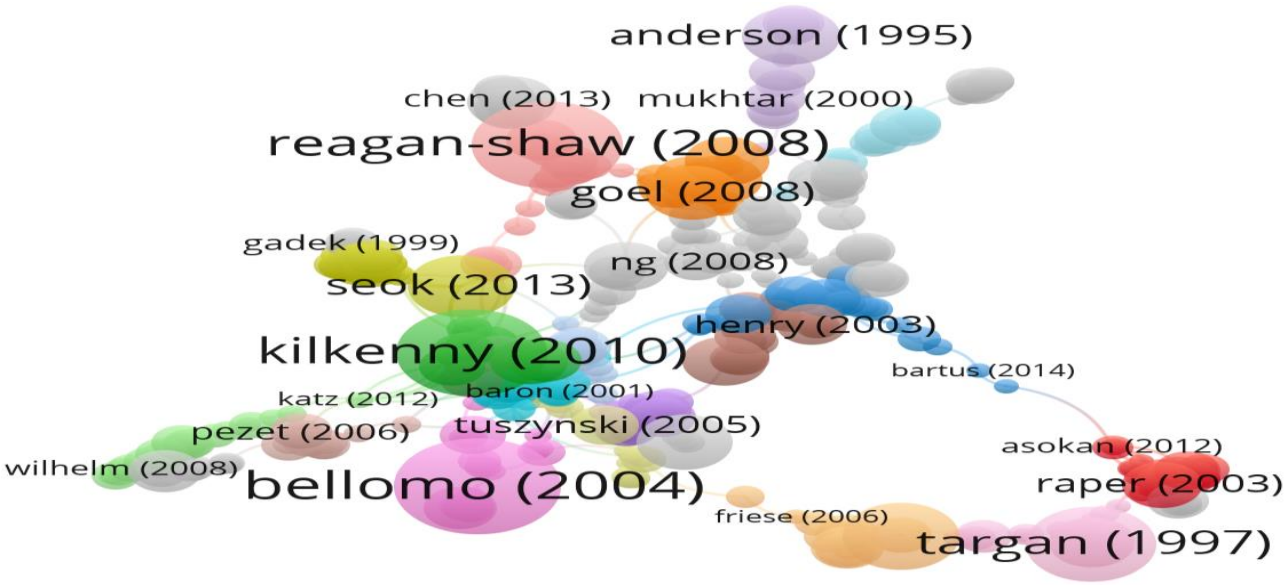
more than 400 Citations. According to Eugene Garfield 222 papers are considered as classic papers.

Table: 7 Highly cited papers

#	Date / Author / Journal	Countries	GCS
1	958 Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P Acute renal failure - definition, outcome measures, animal models, fluid therapy and information technology needs: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group, CRITICAL CARE. 2004 AUG; 8 (4): R204-R212		4181
2	1828 Kilkenny C, Browne WJ, Cuthill IC, Emerson M, Altman DG Improving Bioscience Research Reporting: The ARRIVE Guidelines for Reporting Animal Research, PLOS BIOLOGY. 2010 JUN; 8 (6): Art. No. e1000412		3375
3	1482 Reagan-Shaw S, Nihal M, Ahmad N, Dose translation from animal to human studies revisited, FASEB JOURNAL. 2008 MAR; 22 (3): 659-661		3372
4	253 Targan SR, Hanauer SB, vanDeventer SJH, Mayer L, Present DH, et al., A short-term study of chimeric monoclonal antibody cA2 to tumor necrosis factor alpha for Crohn's disease, NEW ENGLAND JOURNAL OF MEDICINE. 1997 OCT 9; 337 (15): 1029-1035		2538
5	165 Feldmann M, Brennan FM, Maini RN, Role of cytokines in rheumatoid arthritis, ANNUAL REVIEW OF IMMUNOLOGY. 1996; 14: 397-440		2030
6	2196 Seok J, Warren HS, Cuenca AG, Mindrinos MN, Baker HV, et al., Genomic responses in mouse models poorly mimic human inflammatory diseases, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA. 2013 FEB 26; 110 (9): 3507-3512		1757
7	1734 Turnbaugh PJ, Ridaura VK, Faith JJ, Rey FE, Knight R, et al. The Effect of Diet on the Human Gut Microbiome: A Metagenomic Analysis in Humanized Gnotobiotic Mice, SCIENCE TRANSLATIONAL MEDICINE. 2009 NOV 11; 1 (6): Art. No. 6ra14		1666
8	19 SIMOPOULOS AP, OMEGA-3-FATTY-ACIDS IN HEALTH AND DISEASE AND IN GROWTH AND DEVELOPMENT, AMERICAN JOURNAL OF CLINICAL NUTRITION. 1991 SEP; 54 (3): 438-463		1595
9	151 ANDERSON JW, JOHNSTONE BM, COOKNEWELL ME METAANALYSIS OF THE EFFECTS OF SOY PROTEIN-INTAKE ON SERUM-LIPIDS, NEW ENGLAND JOURNAL OF MEDICINE. 1995 AUG 3; 333 (5): 276-282		1454
10	1414 Phinney DG, Prockop DJ, Concise review: Mesenchymal stem/multipotent stromal cells: The state of transdifferentiation and modes of tissue repair - Current views, STEM CELLS. 2007 NOV; 25 (11): 2896-2902		1365
11	850 Nissen SE, Tsunoda T, Tuzcu EM, Schoenhagen P, Cooper CJ, et al., Effect of recombinant ApoA-I Milano on coronary atherosclerosis in patients with acute coronary syndromes - A randomized controlled trial, JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. 2003 NOV 5; 290 (17): 2292-2300		1327
12	1475 Goel A, Kunnumakkara AB, Aggarwal BB, Curcumin as "Curecumin": From kitchen to clinic, BIOCHEMICAL PHARMACOLOGY. 2008 FEB 15; 75 (4): 787-809		1313

13	925 Hamblin MR, Hasan T, Photodynamic therapy: a new antimicrobial approach to infectious disease?, PHOTOCHEMICAL & PHOTOBIOLOGICAL SCIENCES. 2004 MAY; 3 (5): 436-450		1231
14	739 Simopoulos AP, Omega-3 fatty acids in inflammation and autoimmune diseases, JOURNAL OF THE AMERICAN COLLEGE OF NUTRITION. 2002 DEC; 21 (6): 495-505		1201
15	1592 Lal S, Clare SE, Halas NJ, Nanoshell-Enabled Photothermal Cancer Therapy: Impending Clinical Impact, ACCOUNTS OF CHEMICAL RESEARCH. 2008 DEC; 41 (12): 1842-1851		1173
16	1510 Tse C, Shoemaker AR, Adickes J, Anderson MG, Chen J, et al., ABT-263: A potent and orally bioavailable Bcl-2 family inhibitor CANCER RESEARCH. 2008 MAY 1; 68 (9): 3421-3428		1154
17	1662 Ostrand-Rosenberg S, Sinha P, Myeloid-Derived Suppressor Cells: Linking Inflammation and Cancer, JOURNAL OF IMMUNOLOGY. 2009 APR 15; 182 (8): 4499-4506		1147
18	1194 Yen D, Cheung J, Scheerens H, Poulet F, McClanahan T, et al., IL-23 is essential for T cell-mediated colitis and promotes inflammation via IL-17 and IL-6, JOURNAL OF CLINICAL INVESTIGATION. 2006 MAY; 116 (5): 1310-1316		1128
19	380 Jordan A, Scholz R, Wust P, Fahling H, Felix R, Magnetic fluid hyperthermia (MFH): Cancer treatment with AC magnetic field induced excitation of biocompatible superparamagnetic nanoparticles, JOURNAL OF MAGNETISM AND MAGNETIC MATERIALS. 1999 JUL; 201: 413-419		1108
20	1695 Lee RH, Pulin AA, Seo MJ, Kota DJ, Ylostalo J, et al., Intravenous hMSCs Improve Myocardial Infarction in Mice because Cells Embolized in Lung Are Activated to Secrete the Anti-inflammatory Protein TSG-6, CELL STEM CELL. 2009 JUL 2; 5 (1): 54-63		1099
21	991 Valko M, Izakovic M, Mazur M, Rhodes CJ, Telser J, Role of oxygen radicals in DNA damage and cancer incidence, MOLECULAR AND CELLULAR BIOCHEMISTRY. 2004 NOV; 266 (1-2): 37-56		1098
22	1844 Roberfroid M, Gibson GR, Hoyles L, McCartney AL, Rastall R, et al., Prebiotic effects: metabolic and health benefits BRITISH JOURNAL OF NUTRITION. 2010 AUG; 104: S1-S63		1093
23	21 STEINMETZ KA, POTTER JD, VEGETABLES, FRUIT, AND CANCER .1. EPIDEMIOLOGY, CANCER CAUSES & CONTROL. 1991 SEP; 2 (5): 325-357		1077
24	1096 Sharma RA, Gescher AJ, Steward WP, Curcumin: The story so far, EUROPEAN JOURNAL OF CANCER. 2005 SEP; 41 (13): 1955-1968		1076
25	1215 Sartor RB, Mechanisms of disease: pathogenesis of Crohn's disease and ulcerative colitis, NATURE CLINICAL PRACTICE GASTROENTEROLOGY & HEPATOLOGY. 2006 JUL; 3 (7): 390-407		1071
26	2384 Neuschwander-Tetri BA, Loomba R, Sanyal AJ, Lavine JE, Van Natta ML, et al., Farnesoid X nuclear receptor ligand obeticholic acid for non-cirrhotic, non-alcoholic steatohepatitis (FLINT): a multicentre, randomised, placebo-controlled trial LANCET. 2015 MAR 14; 385 (9972): 956-965		1033
27	121 BROWNLEE M, ADVANCED PROTEIN GLYCOSYLATION IN DIABETES AND AGING, ANNUAL REVIEW OF MEDICINE. 1995; 46: 223-234		1021

Document	Citations	Links
o'collins (2006)	891	26
ginsberg (2008)	515	20
gladstone (2002)	492	19
sena (2007)	229	18
fisher (2009)	798	16
van der worp (2007)	309	16
macleod (2008)	203	15
crossley (2008)	156	15
horn (2001)	144	15
perel (2007)	442	15
dirnagl (2006)	228	14
green (2003)	126	14
kilkenny (2010)	3375	14
macleod (2005)	127	13
moretti (2015)	114	13
buras (2005)	525	13
macleod (2004)	311	13
tsilidis (2013)	155	12
ravina (2006)	281	12
tome-carneiro (2013)	271	11
dyson (2009)	187	11



FINDINGS AND CONCLUSION

This study obtained publications and citations data from Web of Science database pertaining to 2555 highly cited papers in Animal Clinical Trials. The study covered only those papers that have received 100 or more citations till March 2021. The high number of citations is perceived as an acknowledgement of intellectual debt and scientific progress. Highly cited papers are typically considered as high-quality science. They constitute an important category of journal papers. Measuring the citation impact of publications with high percentiles is a useful tool to ensure quality assessment of authors, institutions as key (most influential) contributors to science and technology. its publication growth in materials science research significantly and couple this trend with a large number of high-percentile citation papers.

The most productive countries are: USA is the leading country with 1442 (56.4%), UK with 304 (11.9%), Germany 209 (8.2%), Canada 179(7%), Australia (130), Italy (132), Netherlands (116). It is noted that 13 Countries registered more than 10000 Citations, 23 with more than 5000 Citations, 38 Countries with more than 1000 Citations. The most cited Institutions are: Harvard University is leading with 27478 Citations for 108 publications followed University of California San Diego with 14896 Citations for 46 Publications, University of Pettsburgh with 13746 Citations for 38 Publications, Johns Hopikins University with 12120 Citations for 53 Publications. The most cited journals are: Cancer Research published the largest number of the highly cited publications (50 papers, 10620 Citations), followed by Circulation with 9998 Citations for 37 Publications, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA with 9317 Citations for 32 Publications, Lancet with 9181 Citations, JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION with 7547 Citations for 21 Publications and New England Journal of Medicine with 6944 Citations for 11 Publications.

The most cited authors are: Ahmad N with 4554 Citations for 4 Publications followed by Kellum JA and Ronco C with 4372 Citations for 2 publications respectively, Altman DG with 4231 Citations for 3 Publications, Bellomo R, Mehta RL and Palevsky P with 4181 citations for singly publications. The most cited one is “Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P (2004). Acute renal failure - definition, outcome measures, animal models, fluid therapy and information technology needs: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group”, published in CRITICAL CARE with 4181 Citations followed by Kilkenny C, Browne WJ, Cuthill IC, Emerson M, Altman DG (2010). Improving Bioscience Research Reporting: The ARRIVE Guidelines for Reporting Animal Research”, published in PLOS BIOLOGY with 3375 Citations

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